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GB 922850
GB 333347
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(54) Self-propelled vehicle

(57) A tractor 40 has a front axle assembly 50 comprising an axle housing having an inner section 51 and outer sections 52 secured together. Steerable wheels 65 are pivoted to the other housing sections 52 and are driven through double universal joints 62 by respective half shafts 61. Twin propeller shafts 82, taking drive off the rear wheel transmission, supply power to the half shafts 61 through the intermediary of respective pairs of bevel gears 59, 60.

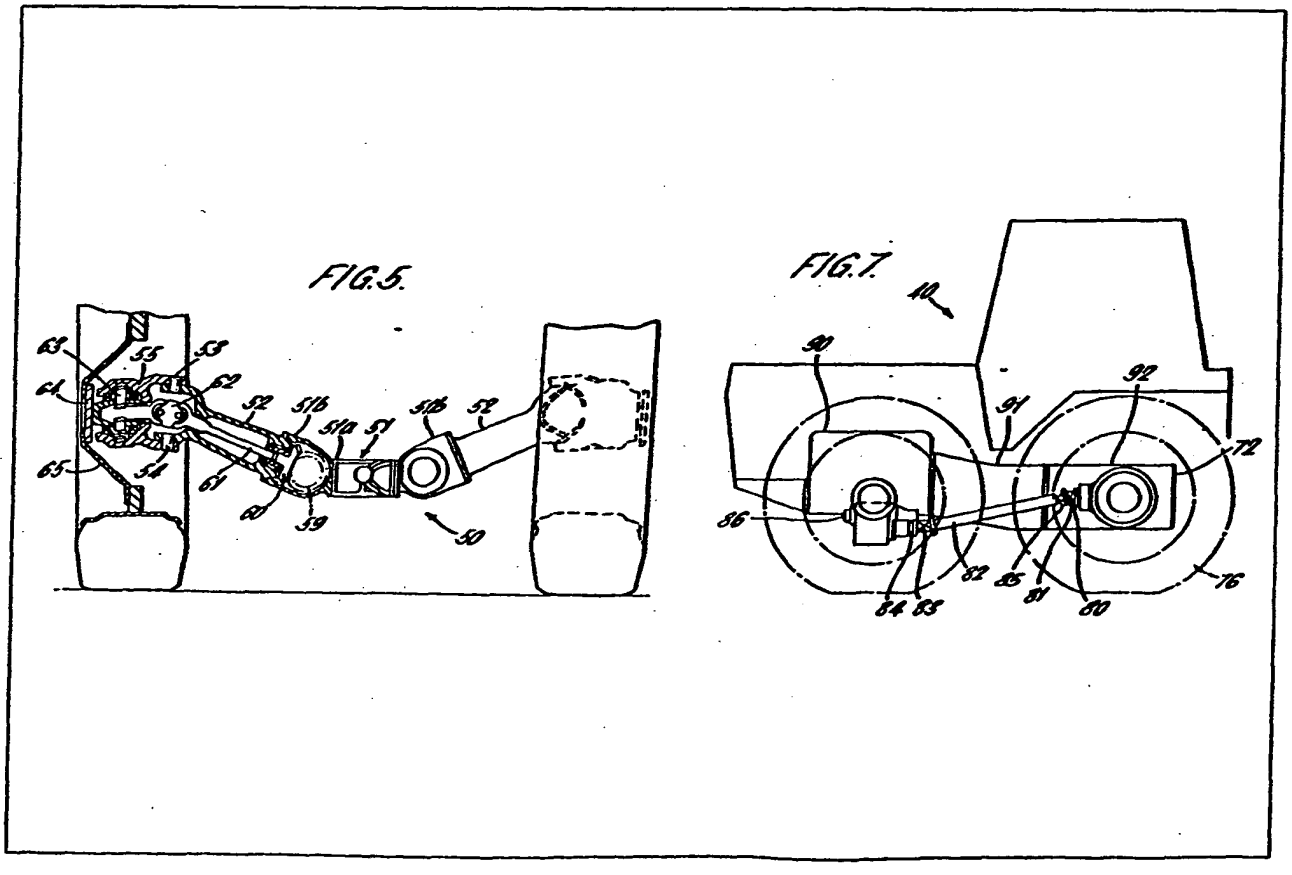

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FIG. 1.

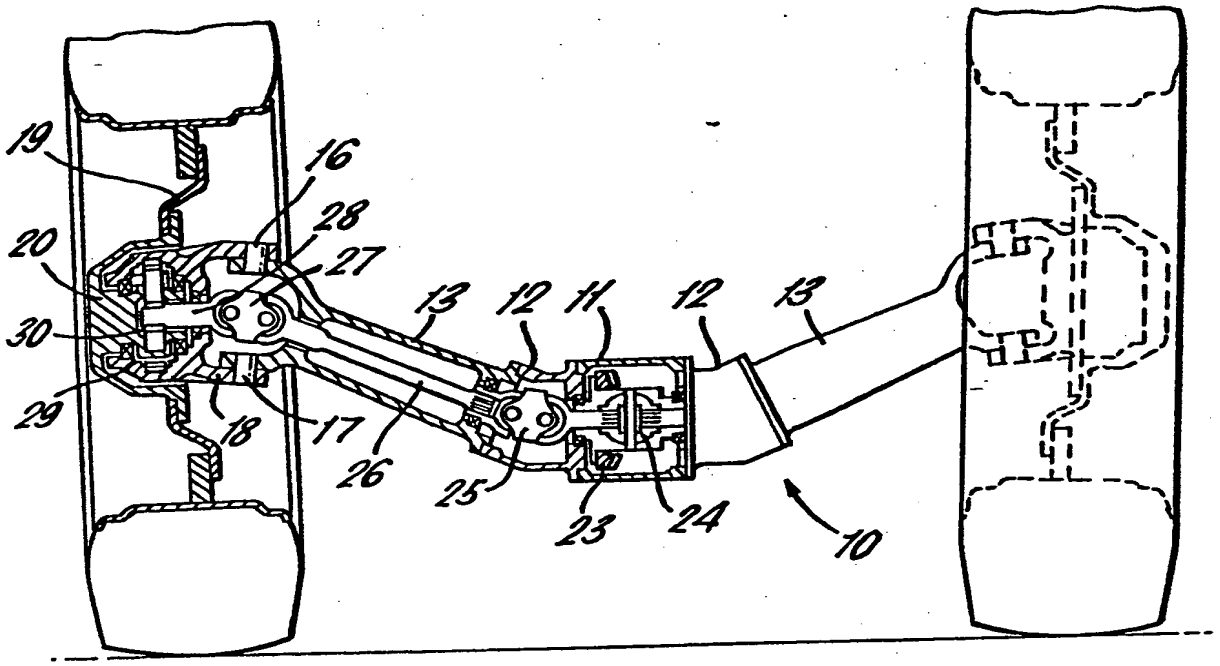


FIG. 2.

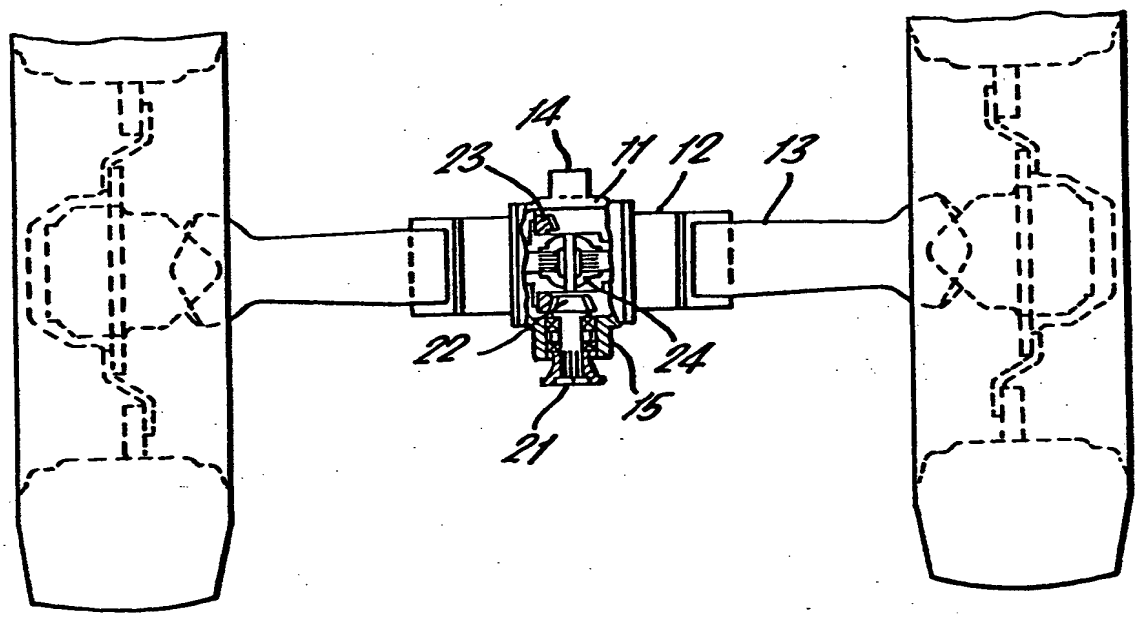


FIG. 3.

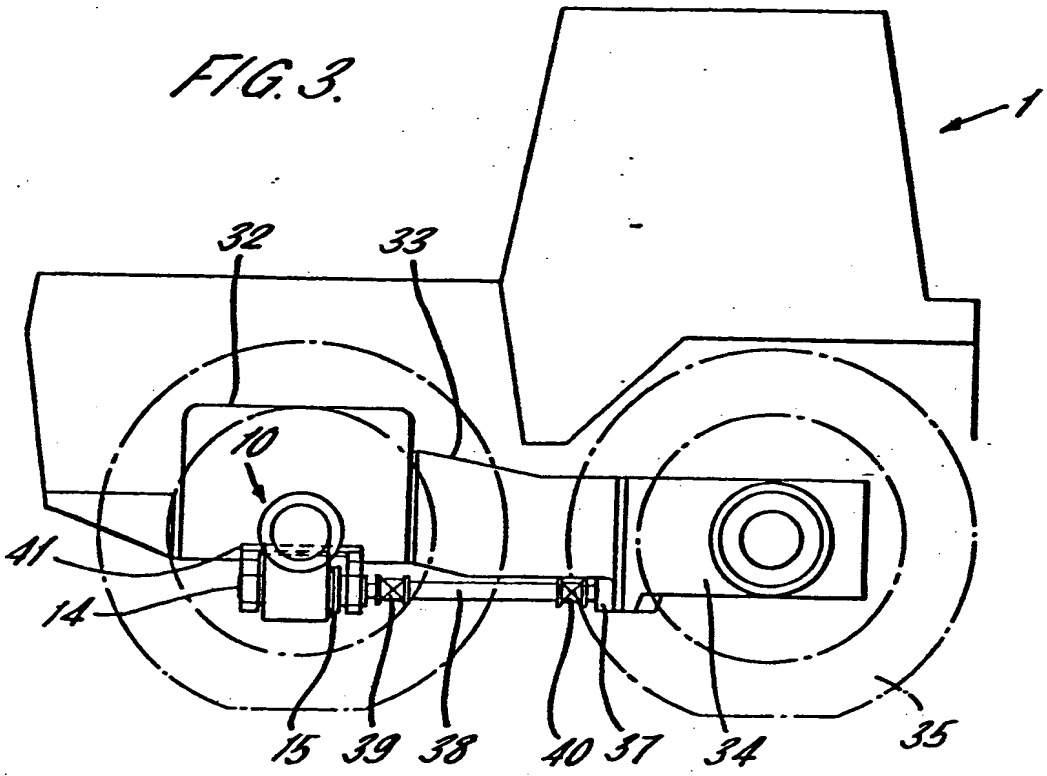


FIG. 4.

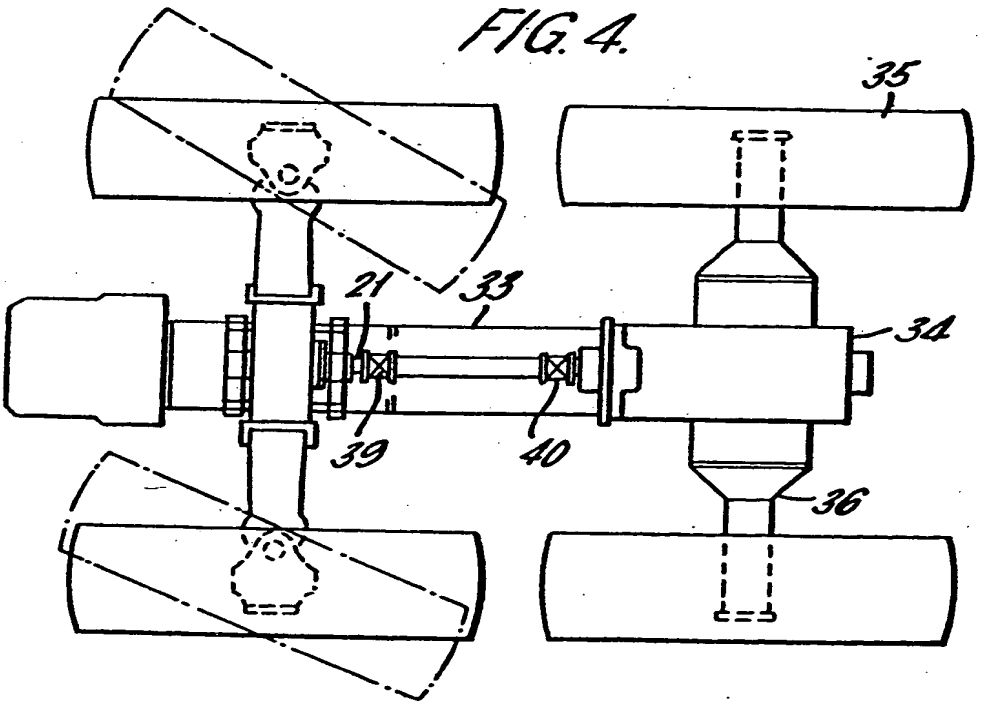


FIG.5.

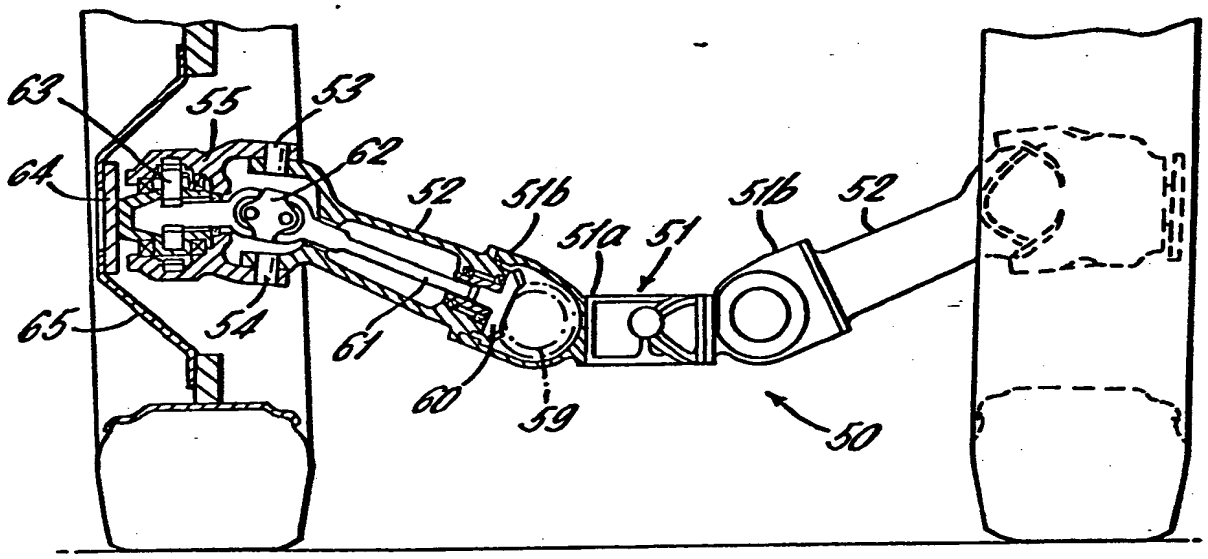

63
55
53
64
62
52
51b
51a
51
51b
52
65
54
61
60
59
50

FIG.6.

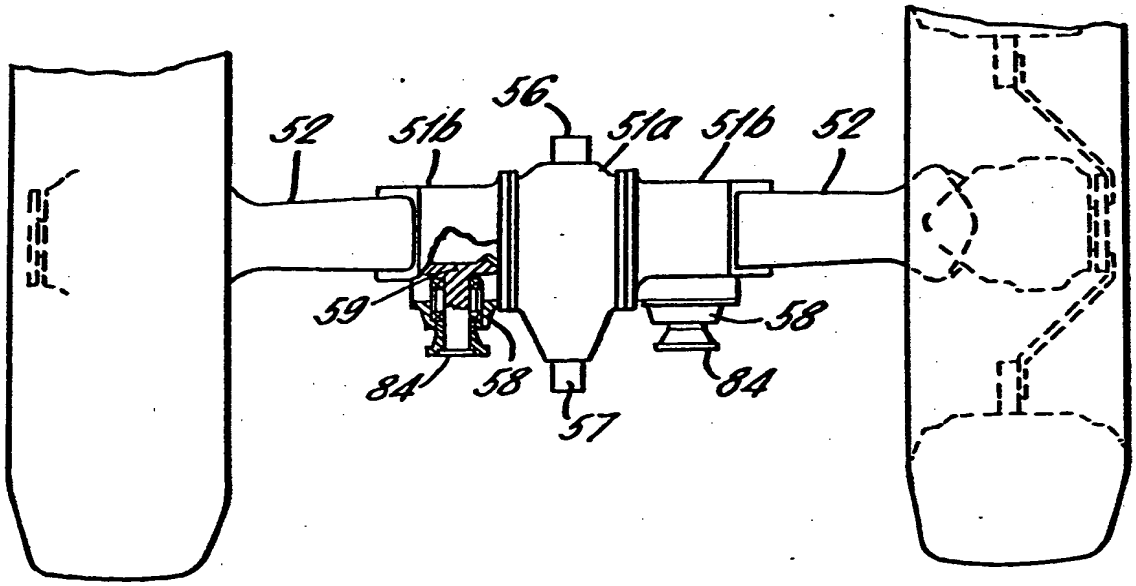

56
52
51b
51a
51b
52
59
58
84
58
84
57

FIG. 7.

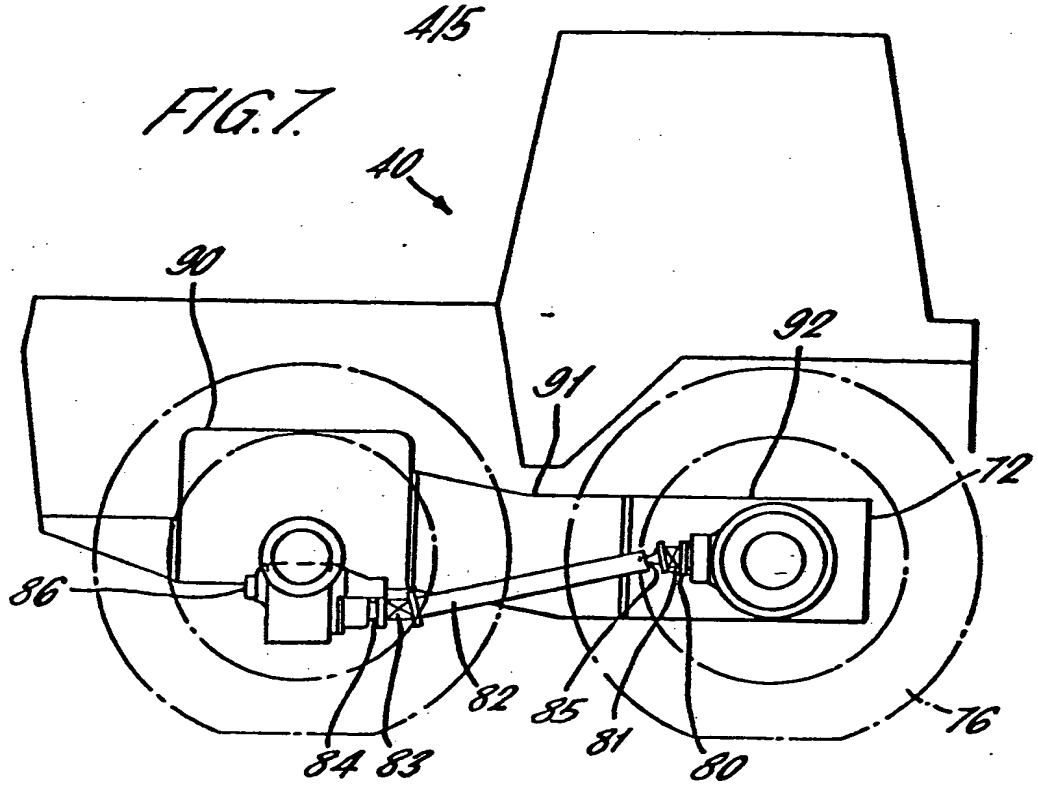
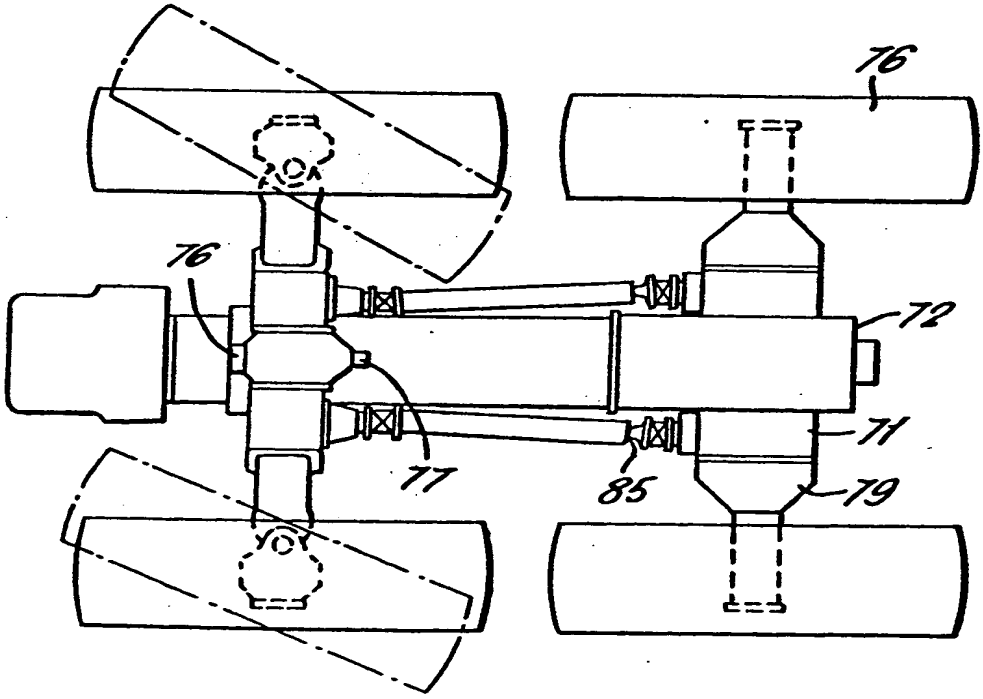


FIG. 8.



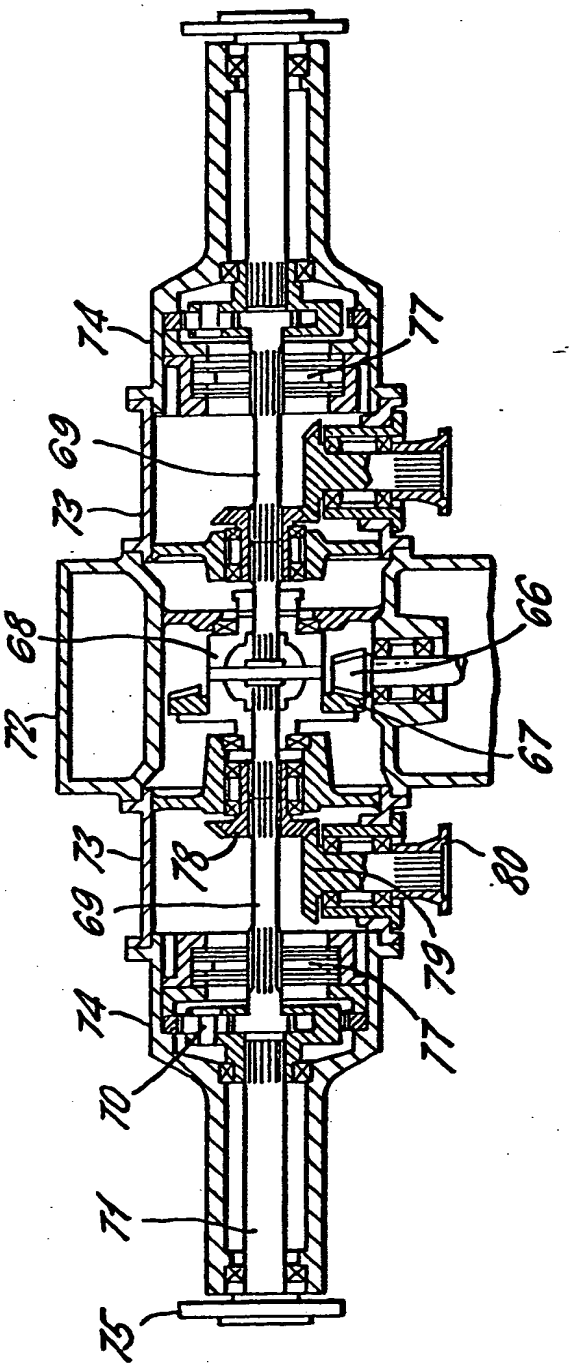


FIG.9.

SPECIFICATION

Self-propelled vehicle

This invention relates to self-propelled vehicles, and relates particularly, but not exclusively, to four wheel drive agricultural and industrial tractors.

In many motor vehicles and tractors it is customary to locate the engine directly above one of the axles in order to achieve satisfactory weight balance. If the axle is a driven axle, the engine must be mounted at a relatively high position in order to allow sufficient space for the transmission and to provide adequate clearance for articulation of the axle housing to follow the contours of the ground. This in turn requires the driver's position to be raised so as to provide him with adequate visibility. This results in an increase in the cost of construction and from a performance point of view is undesirable since it raises the centre of gravity and reduces stability on sloping ground.

In motor vehicles wherein power is supplied to a driven axle by twin propeller shafts, and it is desired that the wheels on the axle be steerable, the conventional positioning of these propeller shafts results in a limitation on the angle through which the steerable wheels can be turned for steering.

The invention provides a self-propelled vehicle having at least one axle assembly and a pair of driven wheels mounted to opposite ends of the axle assembly, the assembly comprising an axle housing having an inner portion which houses a drive mechanism powered, in use, by the vehicle engine and an outer portion on each side of the inner portion which outer portions each house a half shaft drivably connected between the mechanism and one of the driven wheels, each outer portion being generally inclined upwardly from the inner portion towards its respective wheel such that the axes of the half shafts are inclined at acute angles to the line of centres of the wheels.

Each half shaft preferably drives, in use, its respective wheel through a universal joint.

Each half shaft may be journalled in bearings mounted in its respective outer housing portion.

The wheels may be steerable, being mounted rotatably in respective wheel mountings which are pivotably mounted on respectiv outer housing portions about substantially upright axes, whereby to allow th wheels to be steer d.

Each wheel mounting preferably comprises a planetary reduction gear mechanism, through which the respectiv wheel, in use, is driven.

Th vehicle may hav four wheels of which two are steerabl , power being supplied, in us , from the engine to all four wheels.

The axle assembly may be pivotally mounted on the vehicle for pivotal movement of the assembly relative to the vehicle about an axis longitudinal of the vehicle. Such pivotal mounting preferably comprises two bosses formed on the inner housing portion and a cradle secured to the vehicle frame and in which the two bosses are pivotally mounted.

The drive mechanism may comprise a differential gear mechanism of which the two output shafts are each drivably connected to a respective one of the half shafts, each output shaft being preferably drivably connected to its respective half shaft by means of a universal joint.

Alternatively, power may be supplied, in use, to the drive mechanism from the engine by two drive shafts, each half shaft being driven, in use, through the mechanism by a respective one of the drive shafts. In a four wheel drive vehicle wherein the unsteerable wheels are driven, in use, by the engine through a differential gear mechanism, the two output shafts of the differential mechanism may each also be drivably connected to a respective one of the drive shafts, whereby power is supplied, in use to the drive mechanism from the engine. The drive mechanism preferably comprises two input bevel gears each driven, in use, by a respective one of the drive shafts, and two further bevel gears each of which meshes with a respective input bevel gear and which is fast with a respective one of the half shafts. Each input bevel gear may be mounted on an input shaft which is journalled in the central housing portion and which is driven, in use, by a respective drive shaft by means of a universal joint.

The invention further provides a self-propelled vehicle having at least one axle assembly and a pair of driven wheels mounted to opposite ends of the axle assembly, the assembly comprising an axle housing having an inner portion which houses a drive mechanism powered, in use, by the vehicle engine and an outer portion on each side of the inner portion which outer portions each house a half shaft drivably connected between the mechanism and one of the driven wheels, power being supplied, in use, to the mechanism from the engine by two drive shafts, each half shaft being driven, in use, through the mechanism by a respective one of the drive shafts.

Two embodiments of the invention will now be described, by way of example, with r ference to th accompanying drawings, in which;

Figure 1 is a partially sectional elevation of a front axle assembly of a first embodiment of the invention;

Figure 2 is a partially secti nal plan view of the axle assembly of Fig. 1;

Figure 3 is a schematic side elevation of a tractor fitted with th axl assembly of Fig. 1,

being the first embodiment of the invention;

Figure 4 is a partially sectional underneath plan view of the chassis of the tractor of Fig. 3;

Figure 5 is a partially sectional elevation of a front axle assembly of a second embodiment of the invention;

Figure 6 is a partially sectional plan view of the axle assembly of Fig. 5;

Figure 7 is a schematic elevation of a tractor fitted with the axle assembly of Fig. 5, being a second embodiment of the invention;

Figure 8 is an underneath plan view of the chassis of the tractor of Fig. 7; and

Figure 9 is a sectional plan view of the rear transmission housing of the tractor of Fig. 7.

A tractor 1 has a front axle assembly 10 which comprises an axle housing having a central inner section 11 and two outer sections 13 connected to the central section 11 by two angle sections 12. The central section 11 is provided with two cylindrical bosses 14 and 15 which are pivotally mounted in a cradle 41 attached to the tractor chassis. This pivotal mounting allows the axle assembly 10 to pivot about a substantially horizontal axis longitudinal of the tractor 1. The steerable wh els 19 of the tractor 1 are pivotally mounted about substantially upright axes on the extremities of the outer housing sections 13 by virtue of respective final drive housings 18 which may turn about upper and lower pivots 16 and 17 fitted on the outer sections 13.

Power is supplied from the tractor engine through a flange coupling 21 splined to the shank of a driving pinion 22 which is located in bearings in the boss 15. The driving pinion 22 meshes with a crown wheel 23 attached t a conventional differential mechanism 24. Th two output shafts of the differential mechanism 24 are connected by constant velocity joints (double universal or Hooke's joints) 25 to half shafts 26, mounted in bearings in the outer housing sections 13. The outer end of ach half shaft 26 is connected by a further constant velocity joint 27 to a stub shaft 28 which is integral with the sun gear of a conventional planetary reduction gear unit 29. Planetary gears 30 of the planetary reduction gear unit 29 are drivably connected to a whe l hub 20 on which a respective wheel 19 is mounted.

It will be noted that each outer housing section 13 is inclined upwardly from the central section 11 to its respective wheel 19 so that the axes of th half shafts 26 housed within th outer sections 13 are inclin d at acute angles to th line of centres of the wheels 19.

Referring to Figs. 3 and 4, the tractor engin is shown at 32 and is rigidly attached to a rear transmission housing 34 *via* a gear box 33. The rear transmission housing 34 drives the rear wheels 35 in conventional manner through transmissions contained in half casings 36. Power is transmitted from the gear box 33 to the front axle assembly 10 by means of a drive take-off mechanism 37 of conventional design and a drive shaft 38. The drive shaft 38 is connected to the flange coupling 21 and to the take-off mechanism by universal joints 39 and 40 respectively.

Single universal joints may be used in place of the double universal joints 25 and 27 but this will result in some velocity fluctuation between the driving pinion 22 and the wheels 19.

A second embodiment of the invention is shown in Figs. 5 to 9. A tractor 40 has a front axle assembly 50 which comprises an axle housing having a central inner section 51 and two outer sections 52 secured together so as to form a single rigid structure. The central section 51 comprises two similar portions 51*b* fastened to a centre portion 51*a*. The steerable land wheels 65 are pivotally mounted about substantially upright axes on the extremities of the outer sections 52 by virtue of respective final drive housings 55 which can turn about upper and lower pivots 53 and 54 fitted on the outer sections 52. The central section 51 is provided with cylindrical bosses 56 and 57 rotatably mounted in a cradle assembly 86 secured to the tractor chassis. The bosses 56 and 57 allow the axle assembly 50 to pivot about a substantially horizontal axis longitudinal of the tractor in order to provide articulation when the tractor is crossing uneven ground.

The centre portion 51a comprises bearing housings 58 in which are mounted bevel gears 59. The bevel gears 59 mesh with further bevel gears 60 which are journalled in bearings in the inner end of the outer housing sections 52. The further bevel gears 60 are drivably connected through half shafts 61 to constant velocity joints 62 (double universal or Hooke's joints) which in turn drive the sun gears of planetary reduction gear units 63 mounted in the final drive housings 55. The planet gears of the planetary reduction units 63 are arranged to drive hubs 64 which are rotatably mounted in bearings provided in the final drive housings 55. Each land wheel 65 is mounted on a respective hub 64.

Each outer casing section 52 slopes upwardly from the central section 51 towards its respective wheel 65 so that the half shaft 61 which it houses is inclined at an acute angle with respect to the line of centres of the wheels 65.

Fig. 9 shows a sectional plan vi w of th rear transmission housing 92 of the tractor 4[illegible] and which carries the non-steered wh els of the tractor. The rear transmission housing comprises a centre section 72, inner half sections 73 and uter half secti ns 74. The sections 72, 73 and 74 ar all attached together so as to make a rigid structure.

Within the centr section 72 is journalled a drive pinion 66 which is driven by the tractor gear box 91. The drive pinion 66 drives in turn a crown wheel 67 which is attached to and drives a conventional differential assembly 68. Drive from the differential assembly 68 is taken via half shafts 69 to final drive planetary gear assemblies 70 which in turn drive rear axle shafts 71. At the extremities of the axle shafts 71 are formed flanges 75 on which are mounted the non-steered land wheels 76.

Encircling the half shafts 69 and acting through splines on the half shafts 69 are multi-plate brakes 77. First bevel gears 78 are splined to the half shafts 69 and mesh with second bevel gears 79. The second bevel gears 79 are fitted with output flanges 80 which provide drive for the front steerable wheels.

The output flanges 80 drive propeller shafts 82 through universal joints 81. The propeller shafts 82 are connected by universal joints 83 to input flanges 84 which are splined to the bevel gears 59 of the front axle assembly 50. Each propeller shaft 82 is equipped with a sliding telescopic portion 85 to accomodate fore-shortening of the shaft which occurs when the front axle assembly 50 articulates due to suspension movement.

An advantage of the above embodiments of th invention is that the lowering of the central sections of the front axle housings by virtue of inclined outer housing sections and half shafts allows the tractor engine to be correspondingly lowered with respect to the land wheels. This in turn permits the drivers position to be lowered without obscuring his view. Thus the desirable phenomenon of a lower centre of gravity is achieved resulting in improved performance of the tractor, increased stability on sloping ground and a decrease in the cost of construction.

A futher advantage of the second embodiment is that since the twin propeller shafts are connected to the central section of the front axle housing, they do not prevent the front wheels being steered through large angles.

CLAIMS

1. A self-propelled vehicle having at least one axle assembly and a pair of driven wheels mounted to opposite ends of the axle assembly, the assembly comprising an axle housing having an inner portion which houses a drive mechanism powered, in use, by the vehicle engine and an outer portion on each side of the inn r portion which outer portions each house a half shaft drivably connected between th mechanism and on of th driven wheels, each outer portion being generally inclined upwardly from the inner portion towards its respective wheel such that the axes of the half shafts are inclined at acute angles to th line of centres of th wheels.

2. A vehicle as claimed in Claim 1 wherein each half shaft drives, in use, its respective wheel through a universal joint.

3. A vehicle as claimed in either Claim 1 or Claim 2 wherein each half shaft is journalled in bearings mounted in its respective outer housing portion.

4. A vehicle as claimed in any preceding claim wherein the said wheels are steerable, being mounted rotatably in respective wheel mountings which are pivotally mounted on respective outer housing portions about substantially upright axes whereby to allow the wheels to be steered.

5. A vehicle as claimed in Claim 4 wherein each wheel mounting comprises a planetary reduction gear mechanism, through which the respective wheel, in use, is driven.

6. A vehicle as claimed in either Claim 4 or Claim 5 having four wheels of which two are steerable, power being supplied, in use, from the engine, to all four wheels.

7. A vehicle as claimed in any preceding claim in which the axle assembly is pivotally mounted on the vehicle for pivotal movement of the assembly relative to the vehicle about an axis longitudinal of the vehicle.

8. A vehicle as claimed in Claim 7 wherein the pivotal mounting comprises two bosses formed on the inner housing portion and a cradle secured to the vehicle frame and in which the two bosses are pivotally mounted.

9. A vehicle as claimed in any preceding claim wherein the drive mechanism comprises a differential gear mechanism of which the two output shafts are each drivably connected to a respective one of the half shafts.

10. A vehicle as claimed in Claim 9 wherein each output shaft of the differential gear mechanism is drivably connected to its respective half shaft by means of a universal joint.

11. A vehicle as claimed in any one of Claims 1 to 8 wherein power is supplied, in use, to the drive mechanism from the engine by two drive shafts, each half shaft being driven, in use, through the mechanism by a respective one of the drive shafts.

12. A vehicle as claimed in Claim 11 when dependent on Claim 6, the unsteerable wheels being driven, in use, by the engine through a differential gear mechanism of which the two output shafts are each also drivably connected to a respective one of th drive shafts, whereby pow r is supplied, in us , to the drive mechanism from the engine.

13. A vehicle as claim d in either Claim 11 or Claim 12 wherein th driv mechanism comprises two input bevel gears each driv n, in use, by a respective one of th drive shafts, and two further bevel gears each of which meshes with a respective input bevel gear and which is fast with a respective on of th half shafts.

14. A vehicle as claimed in Claim 13 wherein each input bevel gear is mounted on an input shaft which is journalled in th central housing portion and which is driven, in use, by a respective drive shaft by means of a universal joint.

15. A self-propelled vehicle having at least one axle assembly and a pair of driven wheels mounted to opposite ends of the axle assembly, the assembly comprising an axle housing having an inner portion which houses a drive m chanism powered, in use, by the vehicle engine and an outer portion on each side of the inner portion which outer portions each house a half shaft drivably connected between th mechanism and one of the driven wheels, power being supplied, in use, to the mechanism from the engine by two drive shafts, each half shaft being driven, in use, through th mechanism by a respective one of the drive shafts.

16. A self-propelled vehicle substantially as hereinbefore described with reference to and as shown in either Figs. 1 to 4 or Figs. 5 to 9 of the accompanying drawings.

CLAIMS (30 Nov 1981)

1. A self-propelled vehicle having at least one axle assembly and a pair of driven wheels mount d to opposite ends of the axle assembly, the assembly comprising an axle housing having an inner portion which houses a drive m chanism powered, in use, by the vehicle engine and an outer portion on each side of the inner portion which outer portions each house a half shaft drivably connected between the mechanism and one of the driven wheels, power being supplied, in use, to the mechanism from the engine by two drive shafts, each half shaft being driven, in use, through the mechanism by a respective one of the drive shafts.

2. A vehicle as claimed in Claim 1 wherein each outer portion is generally inclined upwardly from the inner portion towards its respective wheel such that the axes of the half shafts are inclined at acute angles to the line of centres of the wheels.

3. A vehicle as claimed in either Claim 1 or Claim 2 wherein each half shaft drives, in use, its respective wheel through a universal joint.

4. A vehicle as claimed in any preceding claim wherein each half shaft is journalled in bearings mounted in its respective outer housing portion.

5. A vehicle as claimed in any preceding claim wherein the said wheels are steerable, being mounted rotatably in respective wheel mountings which are pivotally mounted on respective outer housing portions about substantially upright axes whereby to allow th wheels to be steered.

6. A vehicle as claimed in Claim 5 wherein each wheel mounting comprises a planetary reduction gear mechanism, through which the respective wheel, in us , is driven.

7. A v hicle as claimed in eith r Claim 5 or Claim 6 having four wheels of which two are steerable, power being supplied, in use, from the engine, to all four wheels.

8. A vehicle as claimed in Claim 7, the unsteerable wheels being driven, in use, by the engine through a differential gear mechanism of which the two output shafts are each also drivably connected to a respective one of the drive shafts, whereby power is supplied, in use, to the drive mechanism from the engine.

9. A vehicle as claimed in any preceding claim wherein the drive mechanism comprises two input bevel gears each driven, in use, by a respective one of the drive shafts, and two further bevel gears each of which meshes with a respective input bevel gear and which is fast with a respective one of the half shafts.

10. A vehicle as claimed in Claim 9 wherein each input bevel gear is mounted on an input shaft which is journalled in the inner housing portion and which is driven, in use, by a respective drive shaft by means of a universal joint.

11. A vehicle as claimed in any preceding claim in which the axle assembly is pivotally mounted on the vehicle for pivotal movement of the assembly relative to the vehicle about an axis longitudinal of the vehicle.

12. A vehicle as claimed in Claim 11 wherein the pivotal mounting comprises two bosses formed on the inner housing portion and a cradle secured to the vehcile frame and in which the two bosses are pivotally mounted.

13. A self-propelled vehicle substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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